GOVERNMENT OF INDIA
AGRICULTURE
LOK SABHA

UNSTARRED QUESTION NO:3669
ANSWERED ON:07.04.2003
PROJECTS WITHOUT PRACTICAL UTILITY
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Will the Minister of AGRICULTURE be pleased to state:

(a) whether development of statistical methodology for conducting agricultural experiments/investigations is part of work-mandate of Indian Agricultural Statistics Research Institutes;

(b) if so, whether the Institute conducted a number of projects with their costs running into several crores of rupees during last three years for developing the methodology;

(c) if so, the details of these projects including title, cost involved, statistical methodology developed, papers published and practical utility, project-wise and year-wise during the last three years; and

(d) the efforts made to increase the efficiency of the Institute?

Answer

THE MINISTER OF STATE IN THE MINISTRY OF AGRICULTURE (SHRI HUKUMDEO NARAYAN YADAV)

(a) Yes, Sir.

(b) Yes, Sir.

(c) As given in the Annexure.

(d) A suitable monitoring mechanism has been put in the position and is being operated regularly

ANNEXURE

During the last three years the Institute has initiated the following research projects:

A statistical investigation on the long term effects of fertilizers on productivity of cereal crop sequences (Institute Funded)
To estimate the overall fertilizer treatment effects for each crop sequences
To study the effects of long-term fertilizer use on the yield of different crops
To develop methodology for determining optimal fertilization practice for each the crop sequences
To develop yield prediction models for crops included in different sequences
A diagnostic study of Design and Analysis of Field Experiments(Institute Funded)
To conduct a diagnostic survey of several experiments for identifying different experimental situations so as to provide appropriate methods of analysis of data for each possible situation as well as to develop methodology for data analysis are not available or suitable
To evolve appropriate and modified methods of combined analysis of data from experiments conducted at different locations and/or years by using the concept of nested models
To use the concept of multivariate analysis of variance to analyse the data of experiments with multiple responses
To develop an appropriate but exact method of estimation of variance components from an unbalanced data obtained from block designs with possibly unequal block sizes and varying replications

3. Statistical Investigation on the fertilizer use efficiency in relation to cultural practices (Institute Funded)

- To carry out the combined analysis of cultural cum manurial experiments over years/locations for various crops
- To develop fertilizer response models based on cultural cum manurial trials
- To obtain output input ratios at a various levels of cultural practices of crops

4. Design and Analysis of on Station and on Farm Agricultural Research Experiments: A Revisit AP Cess Funded (Cost Rs.8.95 Lakhs)

- To develop suitable methodology by using data of uniformity trials and past experiments in deciding the shape and size of irregular plots and blocks for future experimentation.

- To develop efficient designs and appropriate methods of analysis of data by exploiting the principle of resolvability, fractional factorials and nested models for experiments on Farm Research.

5. Three-associate class partially balanced incomplete block designs and their applications to partial diallel crosses (Institute Funded)

- To obtain some methods of construction of three associate class partially balanced incomplete block designs and to prepare a catalogue of the available PBIB (3) designs along with those constructed
- To develop a computer module to catalogue, generate and analyse three associate class partially balanced incomplete block designs
- To identify the efficient plans for partial dialler crosses obtained through schemes and to develop computer modules for generation of these plans along with their analysis in completer and/or incomplete block settings

6. Statistical study on completion effects among neighbouring units in field experiments (Institute Funded)

- To study the characterization properties of the designs for investigating competition effects among neighbouring units.
- To obtain (construct) designs for estimating competition effects in one-way and two-way elimination of heterogeneity settings.
- To study the optimality aspects of the designs obtained for competition effects and to prepare a catalogue of the optimal (efficient) designs for these situations.
- To study the competition effects among neighbouring units using the data generated through simulation techniques.

7. Design and Analysis of Agroforestry Experiments (Institute Funded)

- To evolve and document general methodologies for the statistical analysis of data already generated through agroforestry experiments
- To obtain appropriate designs alongwith the layout plans and methodology for the analysis of the experiments under agroforestry system to be suggested to the collaborative centre(s)
- To study the relationship among the various components (trees and crops) in agroforestry.

8. Planning, Designing and Analysis of Experiments relating to Soil Test-Crop Response Correlations (Institute Funded)

- To improve the existing methodology for analysis of on-going STCR experiments
- To carry out planning and designing for the conduct of new set of experiments and subsequently to carry out the analysis of data
- To develop data base for STCR experiments

9. Planning, Designing and Analysis of Experiments planned on stations under the Project Directorate for Cropping System Research (Institute Funded)

- To identify the suitable statistical designs for conduct of experiments according to the technical programme formulated in the annual workshop of the project
- To develop suitable method of analysis for the identified designs
- To statistically analyse the data of experiments conducted at 37 cropping system research centre.

10. Planning, Designing and Analysis of `On Farm` Research Experiments planned under Project Directorate for Cropping System Research. (Institute Funded)

- To provide suitable sampling plan and design for layout of experiments on cultivator`s fields
- To identify the appropriate statistical methodology for the analysis of data collected under the programme of experiments on cultivator`s field and to undertake the analysis of the data of experiments conducted
- To finalise the results of experiments conducted on cultivator`s fields for inclusion in the Annual Report of the project

11. Planning, Designing and Statistical Analysis of data relating to Experiments conducted under AICRP on Long -Term Fertilizer Experiments

- To plan and design long-term experiments
- To try alternative approaches for analysis of data
- To coordinate the work relating to statistical aspects of the project and also to provide necessary information to the Project Coordinator (LTFE) and ICAR

12. Study of Land Use Statistics through integrated modelling using Geographic Information System AP Cess Funded (Cost Rs. 20.33 Lakhs)

- To obtain land utilisation statistics with the help of survey and remote sensing technique
- To study the qualitative aspect of land utilisation statistics obtained through different sources i.e. Census, Survey and Remote Sensing
- To develop model for integration of statistics obtained through different sources

13. Development of GIS based technique for identification of potential agro-forestry area (Institute Funded)

- To identify the important factors responsible for growth of agroforestry
- To construct the suitability index using Spatial-Analytic Hierarchy Process
- To compare the above mentioned index with the Composite development index

14. Pilot study on forecasting of brood-lac yield from Buteamonosperma (Palas) AP Cess Funded (Cost Rs.0.40 Lakhs)

- To identify the factors affecting yield of broodlac
- To develop models for forecasting the yield of broodlac from palas tress

15. Forecasting Sugarcane Yields Using Multiple Markov Chains (Institute Funded)

- To develop models for forecasting sugarcane yields based on higher order Markov Chains
- To develop feasibility of use of data of more than one point of time through growth indices and Principal Component Analysis
- To investigate the usage of lumable Markov Chains in forecast models
- To investigate the behaviour of the proposed and also the existing models for forecasting sugarcane yields after increasing the size of the baseline data set.
- To forecast the sugarcane yields from the developed models and compare them with those obtained from the existing methods

16. Forecasting the loss in yield due to weeds (Institute Funded)

- To examine the growth behaviour of weeds which affect significantly the crop yield under study.
- To find out the relationship between crop yield and weed parameters and to develop methodology for forecasting loss in yield

17. Development of weather based forewarning system for crop pests and diseases NATP (Cost Rs.10.83 Lakhs)

- To generate weather based forecasting models for insect pests and disease development
- To validate the forecasting models

18. Studies on bioecology and population dynamics of major pests of mango (hoppers, fruitfly webber & infloresence midge and guave (fruit-borer) (In collaboration with CISH,Lucknow) (Institute Funded)

- Identification of the underlying law the fruitfly follows in natural way of its own
- The establishment of the relationship of fruitfly population with various relevant lag weather variables/fruitfly population by fitting appropriate models.
- Development of final model by using individual functions fitted above.

19. Assessment of harvest and post-harvest-losses-a mission mode project NATP (Cost Rs.189.00 Lakhs)

- To conduct a pilot study to assess the harvest and post harvest losses of oilseeds, milk, wool, meat, eggs and poultry meat, marine and inland fishery at different levels (Producer, consumer and market)

20. A pilot study on cost of production of Coconut in Kerala-Funded from Coconut Development Board, Kochi, Kerala (Collaborative with Central Plantation Crops Research Institute, Kasargod, Kerala) Coconut Board (CostRs.8.10 lakhs)

- To build reliable and efficient estimates of cost of cultivation of coconut
- To study the agricultural practice in Coconut
- To utilise the information collected in the objective (to study the agricultural practice in Coconut) on input details to formulate more remunerative cultivation practice

21. Estimation of wool production-emerging data needs and a methodological reappraisal (Collaborative with Central Sheep & Wool Research Institute (ICAR), Avikanager (Rajasthan)) AP Cess Funded (Cost Rs.6.00 lakhs)

- To modify the existing sampling methodology for estimation of wool production
- To estimate the breed-wise sheep number, average wool yield and total wool production at district/state level with a reasonable precision.
- To study the socio-economic status of farmers engaged in sheep rearing

22. Jai-Vigyan National Science and Technology Mission on Household Food and Nutritional Security for Tribal, Backward and Hilly Areas) (NATP) (Cost Rs7.88 lakhs)

- To document socio-economic conditions and food security status of the targeted population,
- To assess cost of differential technological interventions in various target domains,
- To identify possible constraints for diversification and wider adoption of improved life support crop species and lied enterprises,
- To quantify the potential benefits of improved technologies and diversification on poverty allevation, food security, income and sustainability of resource base in the target domain,
- To assess implications of improved technology interventions on gender related issues, and
- To examine role of government intervention through on-going programs for wider adoption and larger impact of improved technologies in tribal, backward and hill areas.

23. Study of Lac Marketing in India AP Cess Funded (Cost Rs.19.00 lakhs)

- To study existing marketing channel and price spread in lac marketing
- To examine extent of market integration in lac markets
- To suggest remedial measures for improving marketing environment of lac in India

24. An econometric study of technological dualism in egg production (Institute Funded)

i) To study the extent of technological dualism and change in egg production
ii) To study effect of technological dualism and technological change on functional income distribution
iii) To examine allocate efficiency under different levels of technology

25. Study to formulating long term mechanisation strategy for each agro-climatic zone/state Funded by Department of Agriculture and Cooperation, Ministry of Agriculture) (Cost Rs.130.00 lakhs)

- To study the soil types, land topography
- To study the socio-economic conditions (financial status) of the farmers and farm labourers and assess their capabilities for acquiring adopting the needed agricultural equipment/machinery
- To study the present status, ultimate potential, the gaps, highlighting critical ones; for equipment used in various agricultural operations starting right from village to post-harvest operating
- To study the types and utility of various agricultural equipment, both conventional and improved ones, presently in use and those needed in future, for different crops/cropping systems in the Zones.
- To study the impact of farm mechanisation on employment of labour
- To study the cropping pattern, both agricultural and horticultural, in the Zones, yields in relation to the national average, and their growth potential
- To study and assess the use of arm power per hectare, ultimate requirement, ways and means to fulfil the gaps for various farm operations
- To study the infrastructural facilities for the manufacture, marketing, after sale service/repairs availability etc. of agricultural equipment
- To study and assess the adequacy and the requirement of infrastructure at the central and state levels, for planning, promotion, execution and extension of the various plan programmes on agricultural mechanisation
- To identify new/improved farm equipment that may be needed by the farmers during next 20 years i.e. by the year 2020, for carrying out different farm operations

- To formulate strategies and programmes that may be required for mechanisation of agriculture during the period 2001-2005, 2005-2010, 2010-2015, 2015-2020

26. Technical Efficiency Analysis of Rice Wheat System in Punjab) AP Cess Funded (Cost Rs.5.63 lakhs)

- To estimate the farm level technical efficiency of rice-wheat system in Punjab.

27. On some robust estimation heritability (Institute Funded)

- To examine the influence of non-normality and other assumptions on the estimation of heritability
- To study the effect of aberrant values on the estimates of heritability
- To identify and develop procedures for robust estimation of heritability

28. Empirical investigations on the influence of fixed effects on the estimates of heritability (Institute Funded)

- To study the effect of non-genetic factors on the estimation of heritability and its precision
- To compare the different methods of correction of data by applying the method of fitting constants
- To compare mixed model technique with the above methods for estimation of variance components and consequently heritability

29. Studies on data processing techniques for statistical analysis of large field variability in hilly and salt regions) NATP (Cost Rs16.59 lakhs)

- To consolidate in a comprehensive manner the data processing techniques for statistical quantification of the large field variability in hilly and salt affected soils
- To finalise the algorithms and develop softwares for computerised data processing of the natural variability present in the plantations carried out in uncultivable lands
- To develop computerised techniques for the construction of the fertility gradient maps of examined soil characteristics field variability obtained by using different concepts of statistical methodology
- To formulate computerised data processing technology for correlating the plant growth traits performance with that of soils characteristics

30. Study of Nonlinear time series modelling in agriculture (Institute Funded)

- To study relative merits and demerits of various tests of linearity
- To investigate properties of autoregressive conditional heterosedastic, self-exciting threshold autoregressive and bilinear model from the family of parametric nonlinear time series models
- To develop relevant computer programs for fitting of above models and to apply these to react data from the fields of entomology, fishery, agricultural economics etc.

31. Studies on growth pattern and heritability of fitness traits in Indian breeds of goats (Institute Funded)

- To compare different methods of estimation heritability of fitness traits.
- To compare the adequacy of different non-linear models utilized for studying growth pattern.

32. Dev. of statistical procedures for selecting genotypes simultaneously for yield and stability (Institute Funded)

- To construct new indices for selecting genotypes simultaneously for both yield and stability
- To make comparison among the indices developed, based on standard statistical techniques and on techniques involving simulation
- To develop a computer program for judging desirable genotypes

33. Development of Software for Online Information System on Personnel Management in ICAR (Institute Funded)

- To design and develop database required for manpower of ICAR set up
- To design and develop user interface for online data entry and updating
- To design and develop reports and queries for manpower information management

34. Development of web-site for National Seed Project (N.S.P) (Institute Funded)

- To identify the information to be kept on web.
- To design and develop the database
- To design and develop the web application.
- To configure network for web site and database server

35. Agricultural Field Experiments Information System(Institute Funded)

- Collection of data of Agricultural Field Experiments from
- different Research Stations/Argil. Universities/ICAR Institutes in the country.
- To develop various software for creation, validation and updation of database and for retrieval of information.
- To maintain the database and update it at regular intervals.

36. Institutionalization of Research Priority Setting, Monitoring and Evaluation and Networking of Social Scientists. NATP (Cost Rs.276.13 lakhs)

- Development of monitoring mechanism
- Development of monitoring indicators at different operative levels
- Development of Project Information and Management System (PIMS) and linking it with Internet.
- Training and workshops on monitoring and PIMS Establishing network of agricultural statisticians and economists.

37. Integrated National Agricultural Resources Information System (INARIS) NATP (Cost Rs.335.44 lakhs)

- To integrate existing databases of crops, plant genetic resources, horticultural and plantations crops, spices, animal genetic resources, fish genetic resources, socio-economic resources, agro-forestry system, water resources, agricultural farm mechanization etc.
- To develop and develop comprehensive data base on the above agricultural resources
- To develop resource maps based on various databases through GIS
- To develop warehouse of the above databases

38. Expert System of Extension NATP (Cost Rs.3.51 lakhs)

- To categorize agriculture in sub-areas and collect relevant information of these areas to feed into database (At IARI)
- To make decision rules to process the information (At IARI)
- To design & develop the web based expert system in extension (At IASRI)
- To provide required information to the farmers and extension workers to take decisions before starting the agricultural enterprise (At IARI)

39. National Information System on Agricultural Education on Internet (NISAGENET) (CAS)

- Development of a computerized information system related to National Agricultural Education in India with a data bank containing data collected from all the SAUs and Deemed Universities of ICAR.
- Specification for how best the data collected from primary and secondary sources be stored in the database.
- Development of suitable modules for updation, modification and expansion in the database structure
- Development of application programs for different Report and Queries to meet users requirements.

40. Short Term Training Programs in Information Technology (Cost Rs40.00 lakhs) Revolving Fund Scheme

- To train manpower in the field of information Technology
- To expose the scientist of NARS to lates Developments in Information technology

41. Development of Statistical Package for Agricultural Research (Windows Version) -SPAR 2.0 Institute Funded

- To design and develop the windows version of the SPAR1
- Development of few additional modules which are not available in the SPAR1.

42. Development of Expert System on Wheat Crop Management (EXOWHEM) Institute Funded

- To collect and compile the information from the experts for Wheat Crop Management
- To develop the knowledge base for the Expert System
- To develop inference engine for the expert system
- To develop and implement expert system on Wheat Crop Management

43. Statistical Evaluation of Agricultural Field Experiments conducted in Maharashtra State Institute Funded

- To prepare indices for evaluation of different types of agricultural field experiments.
- To suggest corrective measures for increasing the precision of the experimentation on the basis of indices.

44. Statistical Package for Animal Breeding Data 2 (SPAB 2) Institute Funded

- The immediate objective or Phase 1 of the project will be to develop Window based Version of SPABD using a Programming Language, which should make the software platform independent.

The following projects are completed during the past three years. The details alongwith methodology developed, practical utility and paper published are given below:

1. A study for estimation of area and production of important vegetable crops on the basis of partial harvest.

- Developing a suitable theoretical frame work for sampling from two dimensional populations spread over space and time with particular reference to vegetable crops
- To apply and test the theory on secondary data collected under earlier vegetable surveys at IASRI in order to develop suitable methodology for estimating the production of vegetable crops
- To estimate the total production of important vegetable crops and their yield rates on the basis of partial harvest

Methodology Developed :

Vegetables are short duration crops with multiple pickings. In a selected field (space unit) the pickings are spread over time dimension. In a way the data forms a two-dimensional populations spread over space and time. Fields form the space units and pickings at different points of time form the time units. One way is to completely observe all the pickings thereby reducing the two-dimensional population to usual one dimensional population for which conventional theory of sampling is applicable. But this alternative is not convenient as it restricts the movement of the investigators since they have to observe all the pickings for selected fields and thus it is cost prohibitive method. Therefore method based on partial harvest data, taking sampling on both the dimensions seems to be useful and cost effective for getting the estimates of production of vegetables. Keeping these things in view the present study was planned.

The study was carried out in two phases. In the first phase, the problem was tackled as sampling from two dimensional populations where, in one dimension selection of sampling units were considered while in the other dimension sampling was spread over time in which the selected units were observed. An approach for a variety of sampling designs associated with sampling over time was developed using the varying probability sampling methods. For estimating the variance of (Horvitz-Thompson estimator of populatio total Y), we considered the case of r1r1 (aligned random sampling in both the dimensions)as an approximation to the case of r1sy1 (aligned random sampling along the space dimension while systematic sampling along time dimension) due to non-feasibility of unbiased estimation for systematic sampling situation. This method was tested on secondary data in which different duration of time intervals on which the data was to be collected and also the periodicity for the systematic sampling interval were tackled. It was found that a span of 7 days in the gap of 14 days was a suitable plan for observing partial harvest data for different vegetable crops. In the second phase, a survey was conducted in rural areas of Delhi during 1995-96 through which the methodology developed for estimation of vegetable production based on partial harvest data has been demonstrated.

Practical Utility:

Vegetables are short duration crops with multiple pickings. Estimation of extent of cultivation and production of vegetables poses several methodological problems. Realising the need a series of pilot surveys were conducted by the Institute and the methodology for estimation of area and production at district level has been developed. However, this methodology is based on observing all the pickings of selected plots within a field in a period. This heavily restricts the movement of enumerators as pickings are to be attended in the selected plots as and when it takes places. Keeping this in view some studies were conducted on the basis of secondary data to examine the feasibility of estimating the production of vegetable crops based on partial harvest data. This study has shown the feasibility of utilising partial harvest data in developing the estimates of production. However, the study was limited to identifying pickings/intervals which contributed substantially to the total production and have got highest correlation with the overall yield of the field. The technique of double sampling was used to improve the estimates. The earlier method involves considerable time and more expenditure and also it is difficult to observe all the pickings. Therefore a method based on observing few pickings will be very useful and which involves less time and less expenditure. This methodology will be very useful for estimating the production of crops/commodities with multiple observation over time.

Papers /Reports published/communicated

1. A Study for estimation of Area and Production of important vegetable crops based on partial harvests, an IASRI report 2000 (published).

2. Estimation of production of vegetable crops based on partial harvest data (submitted for publication - Haryana Economic Journal Karnal).

2. Pilot sample survey to develop a sampling methodology for estimation of poultry meat production

- To estimate the poultry meat production through organised farms
- To estimate the poultry meat production through existing integrated sample surveys for estimation of livestock products and
- To develop a suitable sampling technique for estimating the poultry meat production integrating the result obtained under

(i) and
(ii)

Methodology Developed:

A statistical sampling methodology have been developed by which poultry meat production through poultry farms and back yard of Households in village in any area at village /block/district and state level can be estimating at my point of the year with a research degree of precision

Practical Utility:

The sampling methodology developed is useful for estimating of poultry meat production in any area at village block/district or state level. The main advantage is that this can fit into the integrated sample survey for the estimator of production of major livestock products like milk, egg, meat and wool etc.

Paper Published: NIL

3. Estimation of flow and change in dynamic populations (Institute Funded)

- To estimate the structural changes in the population due to cross-movements of units in various classes between two occasions under general development phenomenon
- To estimate the structural changes in the population due to various casual factors
- To estimate the parameter for characterstic of interest in respect of a stationary population and structural changes occurring in that population and
- To estimate the changes in the parameter for the characteristic on account of the structural changes occurring in the population due to cross-movements of units in various classes between two occasions

Statistical methodology developed:

The change and the consequent multi-dimensional flow of an event occurring in any subject field are characteristics of a natural dynamic phenomenon. As such there is no natural static phenomenon in general because every phenomenon is subjected to dynamic characteristics over time. The estimation of flow occurring in an accessible subject field/population as a result of multifarious development` persistence subject to both natural process and generated devices/programs in operation/execution is often felt needful in the impact/evaluation studies such as poverty alleviation programs, etc. There is renewed interest world over on studies on poverty. This interest has arisen from the growing realization in developing as well as developed countries that fruits of rapid economic growth, through various developmental programs have not reached the poor to the extent possible. Core cause of its improper distribution seems to be the basis for the absence of proper need based classification of the population.

Keeping this in view the present investigation was carried out wherein the estimators for compositional changes leading to the flow of dynamic population units due to cross movements thereof in two classes over the two occasions and the estimators for a population characteristic were developed under general developmental phenomenon and various causal factors by adopting the Projective Geometry and Transition Probability Matrix approach.

Practical Utility:

The study would be useful in a variety of ways for example, in considering the probabilities of certain types of mating in genetics, in studying the yearly mobility of labour force and in the fields of agriculture and planning from the view point of knowing the socio-economic status of various classes of the farming community. Broadly the findings can be used for spatially and temporally reorganizing the available/generated manpower/resources in various sectors identified for the development.

Papers published:

Singh, Jagbir and Ramesan, P.M. (2000). Inter classificatory Cross Movements in a dynamic population, Souvenir, International Conference on Teaching and Research in Statistics for the 21st century jointly organized by University of Akron (USA), ISI and University of Delhi at the North Campus of University of Delhi pp.30 (Also presented).

4. Sampling procedures for selection of representative samples of fertilizer from ships (AP Cess Funded)

- To develop sampling methodology for selection of representative samples of fertilizer from ships for the purpose of quality check

Methodology Developed:

This study was undertaken in pursuance of decision taken by the expert committee on specification of imported fertilizer. Appropriate methodology has been developed for the purpose of quality check of fertilizers imported by the Govt. Of India for drawl of representative samples of fertilizer from ship arriving at major as well as minor ports.

Paper Published: -

Practical Utility:

An objective procedure has been developed for drawl of representative samples of fertilizer from ship for the purpose of quality check.

5. Use of remote sensing technology in crop yield estimation surveys

- To test the methodology of stratification based on satellite data in the form of vegetation indices in crop yield estimation surveys

- To obtain improved estimator of crop yield from crop yield estimation surveys using post stratification based on satellite spectral data

Methodology developed:

The results of the project have shown that when the remote sensing satellite data is used in the general crop estimation surveys (GCES) based on crop cutting experiments, the estimator of crop yield estimator is considerably more efficient compared to the usual estimator . These results suggest that the number of crop cutting experiments in GCES can be reduced by about one third without affecting the present precision for crop yield estimation at district level. This could alternatively be used for small area estimation of crop yield at block level. Two small area estimators namely
(i) The Direct Estimator and
(ii) The Synthetic Estimator have been developed and the standard error of most of the estimators at block level is less than 7-8 per cent. Also crop yield forecast model has been developed using the yield data from GCES, satellite data in the form of vegetation indices and the farmer`s eye estimates of yield.

Practical Utility:

The results of these studies provide an integrated approach for crop yield estimation at district level and small area estimation of crop yield at block level by combining the application of remote sensing satellite data in the existing GCES.Also reliable crop yield forecasting model using satellite data and farmer`s eye estimates can be developed which can provide reliable forecast of crop yield about 6-8 weeks before actual harvest.

Papers published:

1. `Small area estimation of crop yield using remote sensing satellite data`. (with Semwal et al) International Journal of Remote Sensing, 2002 Vol.23 No.1, 49-56.

2. Land use statistics and extent of floods during 1997-98 for District Rohtak, Haryana, using remote sensing satellite data.NNRMS bulletin, NNRMS (B) 26 June 2001, NNRMS Department of Space, Govt. of India, 81-85

Papers Submitted for Publication:

Randhir Singh (2002) `Use of satellite data and farmers eye estimate of yieldfor crop yield forecasting` submitted for publication to the JISAS.

6. Use of discriminant function of weather parameters for developing forecast model of rice crop

- To categorise the year into three groups on the basis of weather parameters

- To develop yield forecast model using the disciminant score of weather parameters and the input variables, and

- To examine the validity of forecast model

Methodology Developed:

The technique consists of development of weather score through discriminant analysis and development of forecast model for rice yield using discriminant score of weather variables alongwith inputs and trend. The model was developed for rice in Raipur district.

Practical Utility:

The technique is useful in classifying the crop year into congenial, normal and adverse year with respect to crop yield. The model developed can forecast crop yield two months before the harvest.

Paper published: Nil

7. Pilot study for developing Bayesian probability forecast model based on farmer`s appraisal data on wheat crop

- To develop the bayesian probability model for forecasting the wheat crop yield

- To enlist the factors affecting the crop yield based on farmers` appraisal

Methodology Developed

Bayesian approach of obtaining yield forecast involves the collection of expert opinion data from farmers who are actually engaged in raising the crop regarding their assessments about the likely crop production. The past survey data of actual yield and farmers` forecast in the previous years and current year are taken into account while making the Bayesian forecast for wheat crop for the current year.

Practical Utility:

The study provides an alternative method for forecasting crop yield based upon the expertise of the farmers attained due to their engagement in raising the crop.

Paper published: Nil

8. Development of forewarning system for aphids, Myzus persicae (Sulxer) on Potato

- Development of forewarning techniques to identify aphid free and low period and area for seed production

Methodology Developed:

(i) Non(linear models are developed. Aphid population in different weeks are taken as dependent variable and lagged weather variables are taken as independent variables.

(ii) Complex polynomials using Group method of data handling technique.

Practical Utility:

Developed methodologies are capable of giving predicted aphid population two weeks in advance. Thus appropriate protection measures can be taken. Thus the present methodologies will reduce the load of pesticide.

Paper published: Nil

9. Development of early warning and yield assessment models for rainfed crops based on agrometeorological indices

- To prepare agrometeorological indices for early warning and yield assessment of rainfed crops

- To develop models using agromet indices for early warning and yield assessment

- To validate the models and provide early yield assessment

Methodology Developed:

Since water/moisture availability is the limiting factor affecting the crop growth and ultimately yield of rainfed crops, water balanced technique was used to develop crop yield assessment model. Improvement in the technique was made by assigning weights to the stress / surplus depending upon the stage at which it occurs while preparing the stress index. Crops covered were sorghum, maize and rice for selected districts. Models were validated with recent years` data.

Practical Utility:

The models so developed can be used for monitoring crop growth and forewarning (if any) at any stage of the crop cycle in addition to pre(harvest crop yield assessment. Similar models can be developed for other crops, districts, zones, etc.

Paper published: nil

10. Forecasting fish production from ponds

- To develop appropriate methodology for forecasting fish production from pond

Methodology Developed:

(i) Linear multiple regression models are developed taking fish weight at harvest as dependent variable and fish weight at seventh month, dissolved oxygen, free carbon(di(oxide, pH value and water temperature as independent variables.

(ii) Non(linear statistical models taking monthly fish weights.

Practical Utility:

Methodology developed helps in reliable and timely forecasts of fish production which is important for planners and policy makers. Such an advance information is useful in formulating import and export policies are for exercising several administrative measures for storage and marketing of fish production.

Paper published: Nil

11. Studies on growth pattern and heritability of fitness traits in Indian breed of goats

- To compare different methods of estimation of heritability of fitness traits

- To compare the adequacy of different non-linear models utilized for studying growth pattern

Methodology Developed:

The heritability estimates of female and male animals for each genetic group are obtained for stayability at one month, three months, six month, nine month, twelve month and type of birth by half-sib analysis and by heterogeneity chi-square method. The results of the study has shown that heritability estimates obtained from heterogeneity chi-square may be taken as more appropriate this method should be used for estimation of heritability of threshold trait as compared to half-sib method.

The data for body weight from birth to twelve month of age was adjusted for different non-genetic effects and adjusted monthly data was used to fit different non-linear growth curves. These were tried for each genetic group for each sex separately. On comparing the performance of those curves it was formed that monocular gave the best fit which is closely followed by Gompartz curve. Since, the monocular curve has the drawback that it does not provide the point of inflexion, it was recommended to use the Gompartz curve to obtain the optimum age and maximum growth rate at point of inflexation for different genetic groups of goats.

Practical Utility:

The knowledge of heritability of fitness traits such as stayability at different stages of age of animals, type of birth etc. would be useful for breeders for preparing suitable selection plans for improvement of goats.

The development of suitable growth models that describe the growth pattern of herd can be used to apply selection pressures at discrete point to alter the growth curve pattern to more advantageous types. These curves are useful as they relate age of the animal to its body weight through biological related parameters such as growth ratio. It also provided the optimum age at which the farm animals of different breeds and crosses can be disposed of economically and maximize the profits of the farmers.

Research Paper Published:

Lal Chand, S.D. Wahi & V.K. Bhatia (2001)`Inheritance of fitness traits in goats` Jour. of Res. (BAU), 13(2)

S.D. Wahi, Lal Chand & V.K. Bhatia `Study on growth pattern in crosses and pure Indian Breeds of goats: communicated to Ind. J. Animal Sci. (ICAR)

Lal Chand, S.D. Wahi & V.K. Bhatia (2002) `Studies on growth pattern and heritability of fitness traits in Indian breeds of goats` Project Report IASRI, New Delhi

12. A statistical investigation on the long term effect of fertilizers on productivity of cereal crop sequences (Institute Funded) Year2001

- To estimate the overall fertilizer treatment effects for each crop sequences

- To study the effect of long term fertilizer use on the yield of different crops

- To develop methodology for (a) determining optimal fertilization practice for each of the crop sequences and estimation of average annual net returns for the crop sequences

- To develop yield prediction models for crops prediction models for crops included in different sequences

Statistical methodology developed

The regression analysis was modified to accommodate the situation of repeated observations on explanatory variables. An unbiased estimator of mean returns per hectare per annum over the fertilizer cost at constant prices for a treatment was proposed under a specific error structure and its variance expression was obtained. Moreover, an unbiased estimator of the variance of the average returns was also worked out. Besides, a linear unbiased predictor was proposed for the situation with repeated observations on the explanatory variables when (a) errors are identically independently distributed, and (b) the errors follow AR(1). The methodology was applied to analyze the data of experiments conducted at four centers of the All India Coordinated Research Project on Cropping Systems, PDCSR.

Practical utility

The methodology developed will be useful for analyzing the data from long-term trials conducted by ICAR or SAUs in particular and agricultural scientists in general.

Papers published / accepted for publication / communicated

V.K.Sharma, Rajinder Kaur and A.Sharma.A statistical investigation on integrated nutrient supply system in a long-term experiment on rice-wheat cropping sequence, J. Farming Systems Research and Development. Accepted for publication.

V.K.Sharma and Rajinder Kaur. Analysis of a long-term experiment on rice based cropping systems, Indian J. Agril. Sci. Under referring

13. Design for fitting response surfaces in Agricultural Experiments. AP Cess Funded (Cost : Rs.4.99 Lakhs) Year 2001

- To obtain response surface designs for response optimization and slope estimation when factors are with equispaced levels and/or have unequal dose ranges for both symmetrical as well as asymmetrical factorials

- To obtain response surface designs for qualitative-cum-quantitative factors

- To study the robustness aspects of response surface designs against non-availability of data on some point(s)

- to prepare a catalogue of response surface designs suitable for agricultural experiments

- to develop a computer software for the analysis of the designs obtained and catalogued and to illustrate empirically

Statistical methodology developed

Response surface designs both for response optimization and slope estimation for factors with equi-spaced levels and/or have unequal dose ranges both for symmetrical and asymmetrical factorials have been obtained and catalogued. Robustness of response surface designs against single missing observation has been studied and the designs obtained therein have been reported. A computer programme to carry out the analysis of response surface designs has been developed.

Practical utility

The designs obtained are useful to the research workers in agricultural, horticultural and allied sciences. Some of the designs developed have been used in NARS.

Papers published / accepted for publication / communicated

M.N.Das, Rajender Parsad and V.P.Manocha (1999). Response surface designs, symmetrical and asymmetrical, rotatable and modified. Statistics and Applications, 1(1), 17-34

Abhijit Kar, Pitam Chandra and Rajender Parsad (2001). Osmotic dehydration of banana (Dwarf Cavendish) slices. Journal of Agricultural Engineering, 38(3), 9-17

14. Design and analysis of agro-forestry experiments (Institute Funded) Year 2002

- To evolve and document general methodologies for the statistical analysis of data already generated through agroforestry experiments

- To obtain appropriate designs along with the layout plans and methodology for the analysis of the experiments under agrogorestry system to be suggested to the collaborative centre(s)

- To study the relationship among the various components (trees and crops) in agroforestry system

Statistical methodology developed

The designs and analytical techniques useful for agro-forestry experiments have been described. These techniques have been applied to analyze the data from the experiments conducted at IGFRI, Jhansi

Practical utility

The designs identified and statistical methodology developed for analyzing the data from agro-forestry experiments will provide meaningful inferences to research workers and practicing statisticians conducting such experiments involving several factors.

Papers published / accepted for publication / communicated

Seema Jaggi, V.K.Gupta and V.K.Sharma (2001). Design and analysis of agro-forestry experiments: An overview. Jour. Ind. Soc. of Agroforestry, 3(2), 120-129.

D.P.Handa, Seema Jaggi, A.S.Gill and N.P.Singh (2001). Impact of fruit trees on the yield of wheat crop. Ind. Jour. of Forestry. Under referring.

D.P.Handa, Seema Jaggi and A.S.Gill (2002). Path analysis technique to assess the relationship of wheat yield with its components under agroforestry system. Ind. Jour. of Forestry. Under referring.

D.P.Handa, Seema Jaggi, A.S.Gill and N.P.Singh (2002). A correlation and path coefficient analysis of wheat components under multipurpose tree species. Ind. Jour. of Forestry. Under referring.

15. Fertilizer response ratios for different crops in India (Ministry of Agriculture) (Cost Rs.5.626 Lakhs) year 2001

- To devise suitable statistical procedures for obtaining the response ratios for various crops in different regions of the country

- To obtain the response ratios for different regions based on farmers` field trials

Statistical methodology developed

The study was undertaken with the objective to devise suitable statistical procedure for obtaining the fertilizer response ratios for various crops in different regions of the country. The methodology was used to obtain response ratios for major cereals, pulses, oil seeds and cotton crop using farmers` field trials data at the agro-climatic regions of the country as identified by the Planning Commission and at the State level.

Practical utility

The study was conducted at the request of Ministry of Agriculture, Govt. of India and is useful for assessing fertilizer requirement of the country. The project report entitled Fertilizer response ratios for different crops in India was submitted to the Ministry of Agriculture.

16. Study of demand for agricultural products and its implication for food security in India (Institute Funded)

Statistical Methodology: The study is based on Secondary data published from various sources. The data from consumers expenditure surveys of National sample Survey Organization have also been utilized. The relation between consumption changes with income has been depicted using Engel`s Curve. Income elasticities of demand for various food items in different states of India has been worked out.

Paper Published : Nil

Practical Utility: The finding of the project are useful in planning foodgrains production and distribution. The results will also be useful for researchers and policy makers.

(D) The efforts made to improved the efficiency of the Institute.

The progress of the programmes and projects are being monitored regularly and periodically.